Second Sound Measurements Near The Tricritical Point In ^{3}He-^{4}He Mixtures

MASOUD MOHAZZAB, NORBERT MULDERS,Department of Physics, University of Delaware, MELORA LARSON, AL NASH, Jet Propulsion Laboratory, California Institute of Technology

The tricritical point in the phase diagram of ^{3}He-^{4}He mixtures offers unique opportunities to test our understanding of critical phenomena. Since D=3 is the marginal spatial dimension for tricriticality, associated critical exponents are (exact) integer fraction. In addition, one expects to find logarithmic corrections; along the most tricritical path available, the coexistence curve, the superfluid density is predicted to have the form $\rho_s = \rho_{s0}\, \varepsilon(-ln\varepsilon)^{1/2}$ (ε is the reduced distance to the tricritical point). Attempts to do precision measurements near the tricritical point are frustrated by two competing divergences. In the first place, the concentration susceptibility diverges, leading to severe stratification of the mixture in the presence of a gravitational field. This effect can be largely circumvented by doing experiments in very thin cells. However, a second divergence, that of the superfluid order parameter correlation length, causes finite size effects to come into play already relatively far away from the transition. It can be shown that the in the earth's gravitational field the optimum cell height is of order 100 μm. We will present the results of second sound measurements done in this geometry. This work is supported by NASA.